

What is claimed is:

[Claim 1] An apparatus to traverse a subsea topographic feature, comprising:

a subsea pipeline constructed to carry fluids from a first location across a topographic feature to a second location;
said pipeline including at least one concentrated buoyancy device characterized by positive buoyancy;
said pipeline divided into a first pipeline section extending from said first location to said buoyancy device and a second pipeline section extending from said buoyancy device to said second location; and
said buoyancy device providing a connection between said first and second pipeline sections allowing fluid communication from said first pipeline section to said second pipeline section.

[Claim 2] The apparatus of claim 1 wherein the topographic feature is selected from the group consisting of subsea basins, domes, valleys, cliffs, canyons, and escarpments.

[Claim 3] The apparatus of claim 1 wherein said concentrated buoyancy device is selected from the group consisting of cylindrical buoys, profiled buoys, H-shaped buoys, rectangular buoys, and integrated buoys.

[Claim 4] The apparatus of claim 1 further including a mooring system to retain said concentrated buoyancy device in position, said mooring system including at least one subsea anchor piling and at least one mooring line securing said concentrated buoyancy device to each subsea anchor piling.

[Claim 5] The apparatus of claim 4 wherein said mooring system is located proximate to said first location.

[Claim 6] The apparatus of claim 4 wherein said mooring system is located proximate to said second location.

[Claim 7] The apparatus of claim 4 wherein said at least one subsea anchor piling is a suction piling.

[Claim 8] The apparatus of claim 4 wherein said at least one subsea anchor piling is a driven piling.

[Claim 9] The apparatus of claim 1 further including a flexure control device at said first location configured to reduce bending stress and strain.

[Claim 10] The apparatus of claim 9 wherein said flexure control device includes a flex joint.

[Claim 11] The apparatus of claim 9 wherein said flexure control device includes a stress joint.

[Claim 12] The apparatus of claim 9 wherein said flexure control device includes a swivel.

[Claim 13] The apparatus of claim 9 wherein said flexure control device includes an anchor.

[Claim 14] The apparatus of claim 9 further including a second flexure control device at said second location configured to reduce bending stress and strain.

[Claim 15] The apparatus of claim 9 wherein the topographic feature includes a cliff edge at said first location.

[Claim 16] The apparatus of claim 15 wherein said first pipeline section has a lowest point below said cliff edge at said first location.

[Claim 17] The apparatus of claim 15 wherein said flexure control device is offset from said cliff edge at said first location.

[Claim 18] The apparatus of claim 17 wherein said first pipeline section is above said cliff edge at said first location.

[Claim 19] The apparatus of claim 18 further comprising a mooring system proximate to said first location.

[Claim 20] The apparatus of claim 18 further comprising a mooring system proximate to said second location.

[Claim 21] The apparatus of claim 20 further comprising a second flexure control device at said second location configured to reduce bending stress and strain.

[Claim 22] The apparatus of claim 1 wherein said concentrated buoyancy device is installed separately from said first pipeline section and said second pipeline section.

[Claim 23] The apparatus of claim 1 wherein said concentrated buoyancy device is installed together with said first pipeline section.

[Claim 24] The apparatus of claim 1 wherein said concentrated buoyancy device is configured to be installed simultaneously with said second pipeline section.

[Claim 25] A method for traversing an undersea topographic feature with a subsea pipeline, comprising:

- selecting a location to place a concentrated buoyancy device;
- installing a plurality of suction pilings on a sea floor at the selected location;
- deploying the concentrated buoyancy device to the location and attaching the concentrated buoyancy device to the plurality of suction pilings with mooring tether lines;
- lowering the concentrated buoyancy device to a desired depth at the desired location;
- connecting a first section of the subsea pipeline to the concentrated buoyancy device;
- connecting a second section of the subsea pipeline to the concentrated buoyancy device; and
- connecting a jumper line between the first section and the second section of the subsea pipeline.

[Claim 26] The method of claim 25 further including stabilizing the concentrated buoyancy device with a towing vessel while connecting the first section of pipeline, the second section of pipeline, the jumper line between the first section and the second section, or a combination thereof.

[Claim 27] A method for traversing an undersea topographic feature with a subsea pipeline, the method comprising:

- connecting a first buoyancy device to a first section of pipeline and a second buoyancy device to a second section of pipeline;
- laying the first section of pipeline with attached first buoyancy device in a location substantially before the topographic feature;
- laying the second section of pipeline with attached second buoyancy device in a location substantially after the topographic feature;
- winching and securing the first and the second buoyancy devices together to form a unified buoyancy device; and
- connecting a jumper line from the first section of pipeline to the second section of pipeline.

[Claim 28] The method of claim 27 further comprising operating a remotely operated vehicle to assist in connecting the jumper line from the first section of pipeline to the second section of pipeline.

[Claim 29] The method of claim 27 further including supplying fluid to the first and second buoyancy devices to lower them to a deeper location as they are winched together.

[Claim 30] The method of claim 27 wherein the first section of pipeline is laid with the first buoyancy device positioned partly out of water.

[Claim 31] The method of claim 27 wherein the second section of pipeline is laid with the second buoyancy device positioned partly out of water.

[Claim 32] A buoyancy assembly useful to connect a first subsea pipeline section to a second pipeline section according to the method of Claim 27, the buoyancy assembly comprising:

- first and second buoyancy devices including a hinged basket to swivelably receive a subsea pipeline section;
- a pulley mechanism receiving a tension cable; and
- a latching mechanism to secure said buoyancy devices together opposite said pulley mechanisms.